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Vulnerability of Algiers Waterfront and the New Urban Development Scheme

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Abstract

The main argument of this paper is that the natural balance of Algiers' Bay is endangered by the massive introduction of large high-density urban projects. Despite the fact that the phenomenon of the urbanization concerns most of the Mediterranean coastal areas and cannot be avoided, the research presented in this paper illustrates the negative impacts of these urban developments and argues for the preservation of the natural features of waterfronts.
It starts by the identification of the physical characteristics of the Bay and highlights the vulnerability of this entity as an ecosystem particularly fragile.
On the second step, the new urban development scheme proposed for the development of the Algerian coast will be confronted with the realities of its implementation on the bay. In effect, Algiers coastal zones, and particularly Algiers bay, are at a crucial stage, which requires harmonization of the imperatives of economic development and environmental protection. Some results of researches related to the sustainability of these coastal areas with different trend scenarios will be presented. Key indicators have been introduced by some experts to propose the shift in the Algerian coastal region towards a more sustainable development in the 2015/2020 horizon. These indicators will be used to evaluate the facts after the introduction of priority development projects on the bay.

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1. Introduction

The descriptions of Algiers always refer to the sea, the coast, the bay or the waterfront of the city. This link to the sea, unavoidable since the origin of the city's name itself "El- Djazair" explicitly evokes the "islands", does not explain on its own the recurrent reference to the bay. A large literature celebrates the unique landscape of the bay and its natural amphitheatre [1]. The paper starts by showing that according to the United Nations Convention on the Law of the Sea, Algiers' bay has an almost perfect configuration. However, as many other coastal regions over the world, the vulnerability of the bay is now exacerbated. The paper identifies these exacerbating aspects and their long-term impact on the city. As a unique but vulnerable physical entity, would the bay be able to support the impact of yet another intensive urbanization process? The Algerian coastal zone and especially the Algiers bay are indeed, at a crucial stage and require harmonization between imperatives for economic development and environmental protection.

2. The characterization of bays

For the United Nations Convention on the Law of the Sea "a *bay is a well-marked indentation whose penetration is in such proportion to the width of its mouth as to contain land-locked waters and constitute more than a mere curvature of the coast. An indentation shall not, however, be regarded as a bay unless its area is as large as, or larger than, that of the semi-circle whose diameter is a line drawn across the mouth of that indentation*" [2].
The parameters defined below help in evaluating and characterising a bay:

- S_e= Area of the indentation
- L_o= Opening width
- S_d= Area of the semi- circle having the opening width L_o as a diameter
- $S_e \geq S_d \Longrightarrow Se \geq \pi r^2/2 = \pi (L_o^2/4)/2$

2.1. Characteristics of Algiers's bay

The Algiers bay makes an indentation with an almost perfect semi-circle. It has a diameter of around 15.27m and a peripheral contour of 42.46 km in length, going from 'Cap Matifou' at the east to 'Cap Caxine' at the west. It has an almost insular geographical configuration made of the central flat land and a costal band surrounded by a chain of mountains and hills (Figure 1).

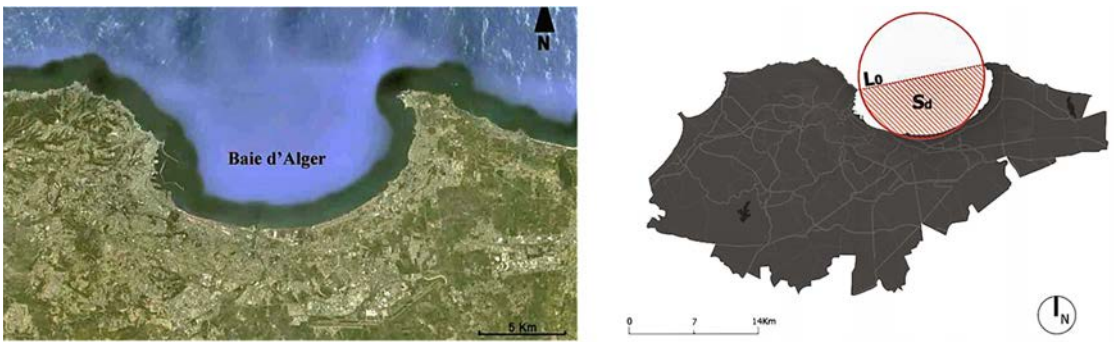

Fig. 1: Algiers' Bay, a clearly defined physical entity. Source: Modified by the author from google earth map.

According to the previous definition of a bay, the characteristics of the Algiers bay are as follows:

- S_e being the area of the indentation, measured between the coastline on the shore and the straight line joining the two natural entrances (east / west) of the bay[2]; S_e is estimated at around 98.8 km^2.
- S_d is the area of the of the semi-circle having the opening width at the entrance of the indentation. S_d can be worked out as:

- $S_d = ½ \pi r^2$ ($r = L_o/2$)
- $S_d = 0.5*3.14*(15.27/2)^2$ **= 91.4km²**

S_d (= 91.4 km²) is smaller than S_e (= 98.8 km²) and hence the above condition is fulfilled.

2.1. Dunar cordon and coastal string

Due to natural erosion, recession and backward movement of the coastal string has seriously affected the Algiers bay. This recession is greatly helped by the abusive sand extraction as well as the degradation of the dunar cordon. This phenomenon is also helped partly by factors generally associated with disequilibrium in sedimentation between the beach and the sea:

- Disappearances of the dunar cordon over the Algiers bay
- Disappearances of the high point of the beach of Bordj El kiffan and Reghaia
- Abusive extraction of the sand from beaches and river banks
- Drought and sever climatic conditions
- Over-frequentation of the beaches at summer without any controlled concession with the installation of large parking areas on the high points of the beaches.
- Construction of buildings on the beaches.

3. The Bay of Algiers, a seismic zone

The bay of Algiers is located in a seismic zone. The convergence of the tectonic plates generates important active faults (Figure 2). The history of the seismicity reveals the existence of other potentially active faults in the Mediterranean Sea and around the bay [3]. These faults have induced the most important earthquakes of Algiers so far that is in 1365 and in 1716 and induced a tsunami that has washed away all the lower part of the town.

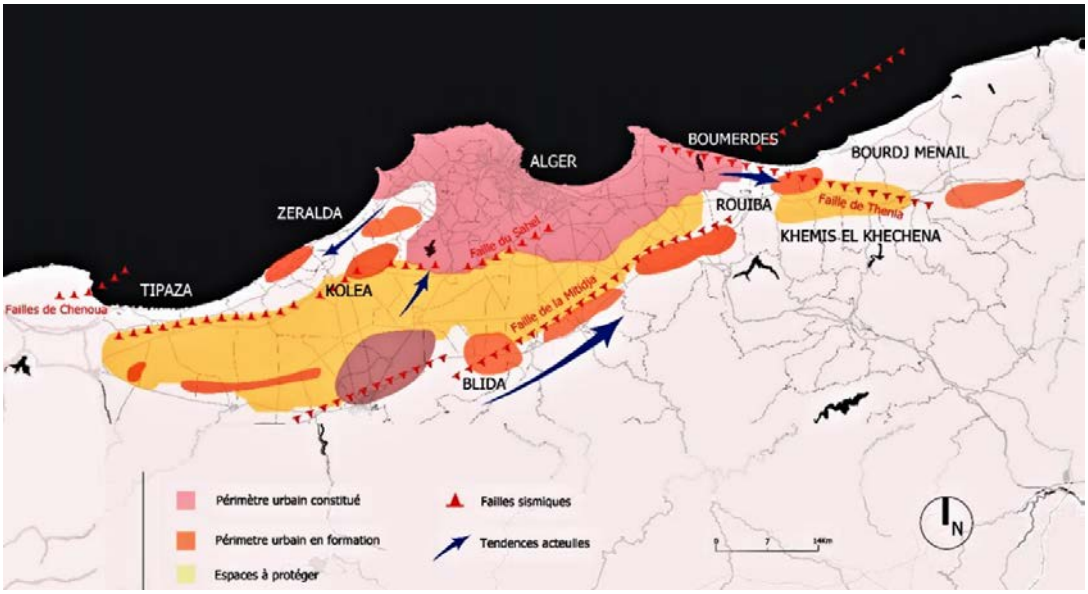

Figure 2: Active faults on and around the bay. Source: Parqueexpo (2011).

The latest important earthquake which has stricken the Algiers region in 2003 (with a magnitude of 6.8 on the Richter scale), with its epicentre in the wilaya of Boumerdes to the east of Algiers, has caused the death of 2278 persons, injured more than 10 000 people and left 180 000 humans without shelters. In Algiers, 8500 flats were destroyed and more than 8000 have been seriously damaged [4].

4. Flooding

In addition to the major risk linked to the seismicity, the vulnerability of Algiers bay is exacerbated by other natural hazards whose consequences are accentuated by the intensive urbanization as well as the climatic changes. The flooding of bab-El Oued in 2001 have demonstrated the severe consequences of a miss-management and the non-consideration of such a risk. The flooding catastrophe that has stricken Bab-El-Oued on 10 November 2001 is in fact due to torrential autumnal rains (240 mm in 24 hours, with 130 mm within a period from 7.00 AM to 9.00 AM, over an impluvium of 40 km^2). The anarchic occupation of the banks of Oued M'kessel and their deforestation have helped such flooding and induced sever mud outflows.

5. Pollution

The pollution through heavy metals, hydro carbonates, nitrates and phosphates is very high at the bay of Algiers. Samples taken from the river 'Oued El Harrach' mouth have shown that the contents of copper, lead and zinc are relatively very high and are dumped without any chemical treatment by local industries situated in the industrial zone on the upstream of the river. Some hydrocarbon pollutions, consisting of fuel leakage, are regularly found in the different fishing ports. In this sense, the Algiers port is classified as the most at risk in the coastal territory of Algeria.

6. Over-densification and concentration of the population

One in ten (1/10) of Algiers inhabitants live in the coastal zone of Algiers. The Algerian Coastal territory itself gathers around 40% of the total population spread over a territory, which represents 1.9% only of the total territory of country. Such concentration is clearly illustrated by the density that reaches 3144 inhabitants/km^2 for the county of Algiers against 245 inhabitants/km^2 for the total coastal band of the country and 12 inhabitants/km^2 for the whole territory of Algeria [4].

The urbanisation ratio itself was 94.30% in 2008, which is a lot higher than the national urbanisation ratio of 65.94% at the same period. Such concentration of the populations over the coastal regions is not however specific to Algeria only, but can be found particularly in the Mediterranean region. Consequently, the structuring equipment are mainly localised in the coastal band and hence have further negative impacts, particularly from the ecological point of view, such as:

- In Algiers, the agricultural land is drastically reduced to reach a mere 0.07ha per inhabitant.
- Acceleration of the recession phenomenon of the coastline and its backward movement, acceleration of the deforestation and increasing pressure on the water resources.
- A tendency of conurbation on the Algiers coastal band, with a continuity from Ain Taya at the east Algiers to Zeralda to the west of Algiers. Hence, 54% of the linear coastal bands are artificialized [6].

7. The urgent need for the protection of Algiers bay

Aware of the vulnerability of the coastal band, Algeria, as the other Mediterranean countries, has introduced a law for the protection and the valorisation of the coast. This law came to strengthen the legislative mechanisms for the management of land in the coastal regions and particularly to preserve the inestimable landscape patrimony of the Algerian coast. According to the Mediterranean Spatial Plan (PAM) and the Bleu Plan (Plan Bleu), Algeria as a Mediterranean country has introduced a certain number of actions for the preservation of its coastal areas.

7.1. The Coastal Spatial Plan for the Algiers coastal zone

Based on a number of diagnosis and different national reports on the state of the environment, the Coastal Spatial Plan (PAC) established according to the Mediterranean Management Plan (PAM) has delimited the coastal zone and recommended the supervision of all urban actions in addition to the restraint of the coast artificialness. In effect, this should rapidly lead to curbing the negatives consequences of the development on the coast and its coastal resources and protecting the marine environment.

An observatory of the littoral or coastline has even been created. However, in 2007 and at the same time as the

revision of the master plan for urban planning (PDAU), a spatial plan for the bay of Algiers was launched. Furthermore, starting from 2004, and in collaboration with the Blue Plan, international experts applied the approach *Imagine* [7] to the Algiers' coastline, and developed different scenarios for a sustainable management of the coastal zones. This approach is based on a collective brainstorming of all the concerned actors for futures that are possible and desirable. The expected results of this reflection include a description of what would be a desirable future and the actions to be taken for achieving this future. The experts proposed also a list of indicators for sustainability, which constitute a dashboard for monitoring the progresses of the territory towards a sustainable development. In the case of the spatial plan of the Algiers coastline (PAC), the key indicators positioned on an AMOEBA scheme (Figure 3) show that already in 2003, the area was undergoing strong pressures. The graph AMOEBA shows that among the 21 indicators, 20 are outside the equilibrium band and do not respond to the sustainability criteria pre-established. It also shows that most of the indicators are located outside the equilibrium zone (11 indicators are not sustainable by default, nine (9) are not sustainable by excess and one only is located within the equilibrium zone). This graph helps in determining the urgent actions to be taken in order to bring the indicators back to the equilibrium zone and estimate the most immediate gains in durability and sustainability or those which are the less difficult to reach. Is the spatial project of the bay, which has been adopted, in line with this approach for the search of a progressive equilibrium?

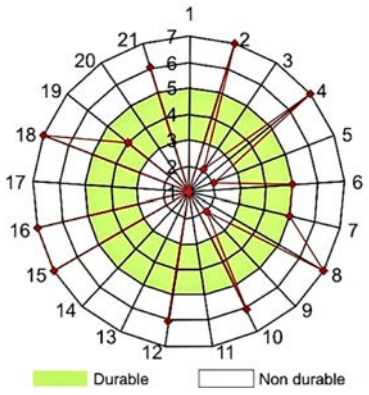

Figure 3: Graph AMOEBA showing that 20 indicators are outside the equilibrium band, [5].

8. Algiers' bay development plan

The development project of the bay of Algiers, considered as the mirror image of the modern Algeria, was selected through an international tender. The French group Arte Charpentier proposed to transform Algiers to a Mediterranean Eco metropolis.

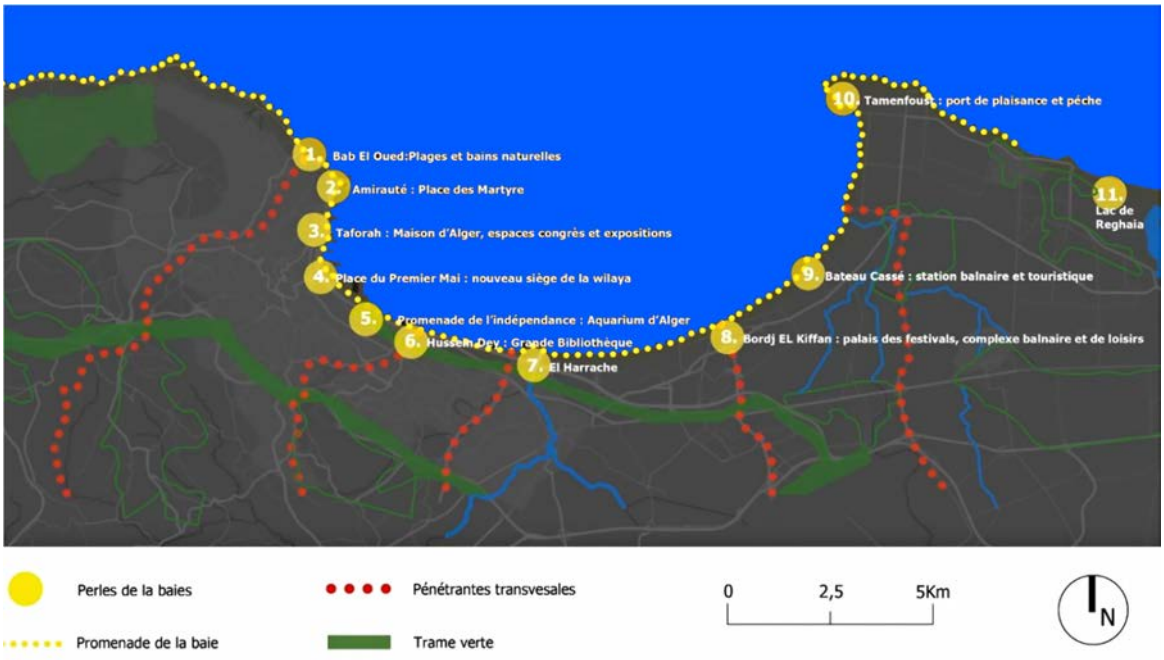

Figure 4: Algiers' Bay proposal of development. Source: modified by the author from an original sketch from [9].

The project for the whole bay of Algiers extends over a length of 50 km and an initial width of 500 m. It is the result of a "rapid acting "policy for the city of Algiers and the will of stopping a tradition of a "day-to-day" [8]. It represents an introduction of a new way of making urbanism. An urbanism based on a global vision at the scale of Algiers bay and its hinterland. In effect, the articulation of the plan around the structuring and priority projects, identified beforehand is supposed to attract new activities, induce new developments and lead to the positive transformation of strategic sectors and quarters (see Figure 4). The spatial project of the bay itself integrates the environmental dimension. This preoccupation is clearly expressed by the design office Arte Charpentier who states explicitly that their consortium integrates a team of environmentalists [9]. It is true that the different plans take into consideration the restoration of the green eco-systems of the capital city. They also suggest some structuring interventions such as the design of green lungs at Reghaia to the east and at Bainem to the west, the creation of new urban parks and agro-parks, the landscaping of the motorways and the development of the greener grid on the whole of the city. The blue plan is also responsible for the management of all the refusals, the quality of drinking water and the spatial design of the coastline. However, the consortium does not provide any reference not development scenario based on clear indicators. On the contrary, this development plan is articulated around new structuring projects, which will generate in the middle term new urban poles and hence an artificialness of an already saturated coast. In effect, a group of experts, working on the integrated management of Algiers coast, have elaborated development scenarios for the horizon 2015 and showed that the coastline is already heavily urbanized and would rather need to be protected and preserved. Adopting a special plan for bay, which encourages the urbanization of the coast, illustrates once more that notwithstanding the exposed will, the development projects continue to be carried out on a day-to-day basis, without any anticipating and prospective vision.

8. Conclusions

Aware of the vulnerability of its coastal strip, Algeria, as all the other Mediterranean countries, introduced a law for the protection and development of the coastal area. This law came to strengthen the legislation on land management and preserve the valuable landscape heritage along the Algerian coast. It is also within the scope of application of this law (02-02) that the MATE (Ministry of town and country planning and environment) has launched the development of "Coastal Zone Management Plans" for the 14 cities on the coast. However, the legislation is not very effective and should be followed by real implantation measures. The evident vulnerability of the bay of Algiers does not imply necessarily the slowdown of its development. After identifying the pressure and menaces that threaten this coastal ecosystem, it is suggested to engage long-term actions that will ensure it preservation as well as it development. Indeed, the acute problem of protecting coastal sites is nowadays, fully integrated to all the obstacles encountered, particularly that of urbanization and the occupation of the coastal space. This development process linked to an integrated management of the waterfront on one hand, and the analysis tools for the sustainability on the other hand, could help in taking the convenient protecting actions, taking into account the different components of the coastal zone with its constraints and potentials.

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